



HACKTIVATION

FOXTALKS

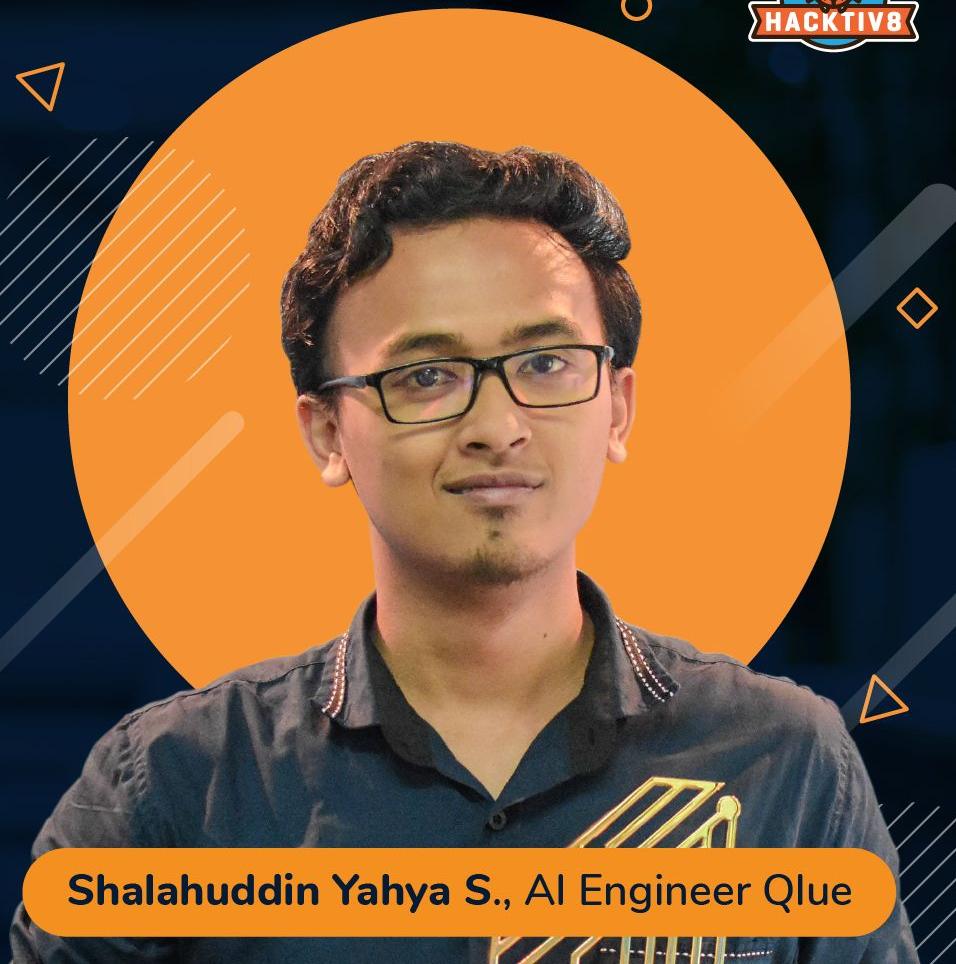
In Collaboration with **q^{lue}**

VOL 13

AI Innovation to Support Government Program

Thursday, 11 June 2020
19.00 - 20.00 WIB

Free Webinar



Shalahuddin Yahya S., AI Engineer Qlue

AI Solution to Support Government Program



Let me introduce myself



M. Shalahuddin **Yahya** Sunarko

AI Engineer Lead in Qule

- Bachelor of Engineering in **Engineering Physics**, UGM
- > 1.5 years in **AI/CV Development**
- NVIDIA **Deep Learning Institute** certified
- Speaker of **PyCon ID 2019**
- AI and High Performance Computing Enthusiast
- LinkedIn: linkedin.com/in/muhammadsyahyas
- GitHub: github.com/muhammadsyahyas

Qlue Smart City

Clients & Partners

q^{lue}

Smart Nation (5)



Smart City (20)



+9

Safe City (23)



+12

Smart Property / Building (300)



sinarmas land



WKA
Inovasi Untuk Solusi



AGUNG SEDAYU GROUP



MERAH CIPTA MEDIA



INDUSTRIAL ESTATE



...

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- ★ Introduction
- ★ COVID-19 in Indonesia
- ★ Qlue AI Solutions for the Pandemic
- ★ Qlue AI Solutions Development
- ★ Mask Detection Development
- ★ Expected Impacts
- ★ Summary



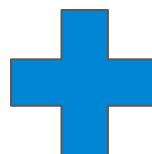
COVID-19 as Today Nation's Issues



How we Identify Solution Needed?

There are 2 variables that should be considered before launch a solution, they are:

- 1. Baseline Information:**
 - a. Condition & problems
 - b. Common needs



- 2. Internal Resources:**
 - a. Manpower Supply
 - b. Skill & knowledge
 - c. Network to Authorities



Tangible Solution



Current Condition and Problems

Government Statement

TEMPO.CO
ENGLISH VERSION

Coronavirus Pandemic; State of Emergency

19 March 2020 18:58 WIB

6 COMMENT



A worker sprays disinfectant at Taman Mini Indonesia Indah (TMII), which is closed due to the coronavirus disease (COVID-19) outbreak spreading

<https://en.tempo.co/read/1332514/jakarta-council-says-rp600000-social-funds-means-4-aid-packages>

Pandemic Risk Estimation from Expert

THE CONVERSATION

Disiplin ilmiah, gaya jurnalistik

Without major intervention, Indonesia could have 71,000 COVID-19 cases by April's end

Maret 28, 2020 12:14pm WIB

A nurse looks out of the isolation room for patients infected with COVID-19 at Undata Hospital, Palu, Central Sulawesi, Indonesia March 3, 2020. ©FAJAR/RUSTAM



<https://theconversation.com/without-major-intervention-indonesia-could-have-71-000-covid-19-cases-by-aprils-end-134239>

Impact Numbers Increases Dramatically



JAKARTAGLOBE

A man rides a motorcycle inside a neighborhood in Tambora, West Jakarta, on April 1. The neighborhood has announced a self-imposed lockdown amid Covid-19 fears. (JG Photo/Yudha Baskoro)

Indonesia's Covid-19 Cases Hit 2,000 with 191 Deaths

BY :BAYU MARHAENJATI, HERU ANDRIYANTO
APRIL 04, 2020

<https://jakartaglobe.id/news/indonesias-covid19-cases-hit-2000-with-191-deaths>

Our Common Needs



President Joko Widodo, right, and State-Owned Enterprises Minister Erick Thohir visit a makeshift hospital at the former Asian Games Athletes' Village in Kemayoran, Central Jakarta, on Monday. The facility is designated for Covid-19 patients. (Antara Photo/Hafidz Mubarak)

Indonesia Needs More and Better Health Facilities to Counter Coronavirus Epidemic: Ombudsman

<https://jakartaglobe.id/news/indonesia-needs-more-and-better-health-facilities-to-counter-coronavirus-epidemic-ombudsman>

The Jakarta Post

NEWS > NATIONAL

Indonesia to evaluate partial lockdown as companies, factories continue business as usual

Budi Sutrisno
The Jakarta Post

Jakarta / Tue, April 21, 2020 / 07:07 am



<https://nasional.kompas.com/read/2020/04/06/10130561/jokowi-sebut-mua-orang-yang-keluar-rumah-wajib-pakai-masker>

KOMPAS.com

Home / News / Nasional

Jokowi: Semua Orang yang Keluar Rumah Wajib Pakai Masker

Kompas.com - 06/04/2020, 10:13 WIB

BAGIKAN:

Komentar (34)



<https://www.thejakartapost.com/news/2020/04/20/indonesia-to-evaluate-e-partial-lockdown-as-companies-factories-continue-business-as-usual.html>

“How do they run the **public surveillance** efficiently?”

Internal Resources

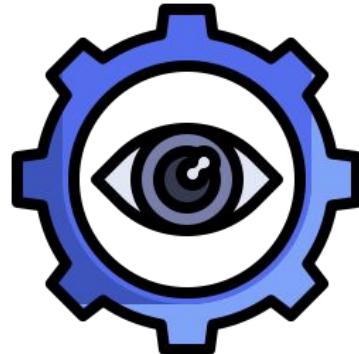
Manpower Supply:

- Engineer
- Project Manager



Knowledge & Skill:

- AI & IoT



Network to Authorities:

- BNPB
- Sekretariat Presiden



B N P B

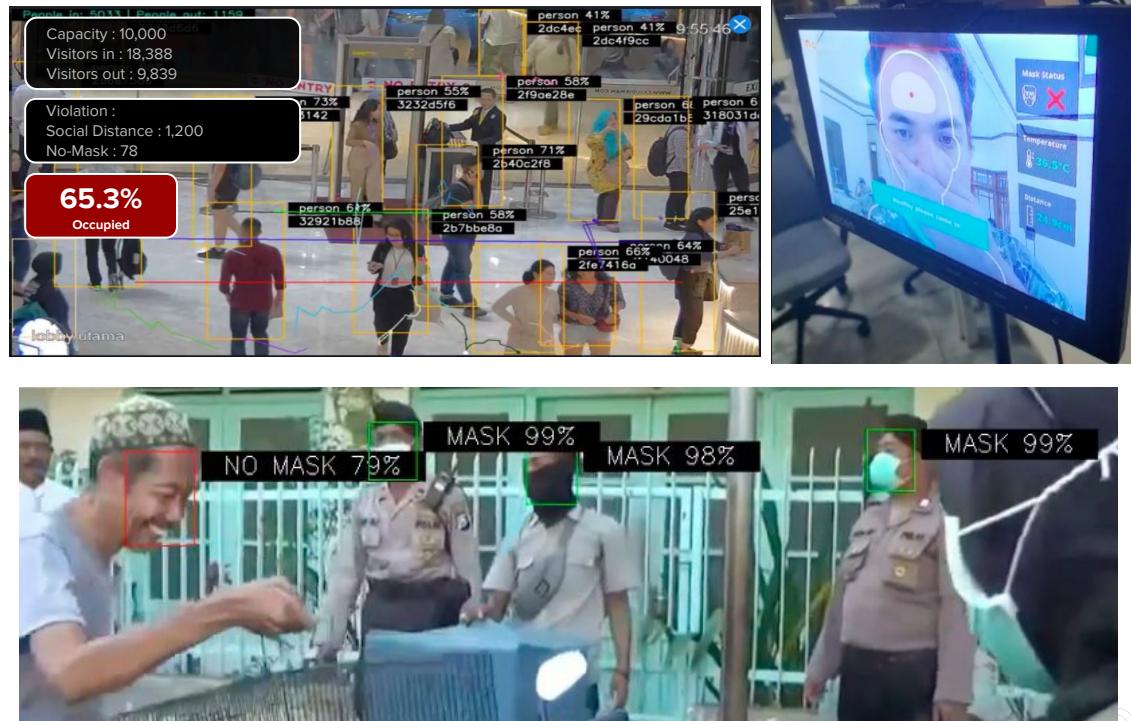


Qlue **AI Solutions** to Solve Pandemic



Teknologi AI untuk “new normal” dan *Smart City*

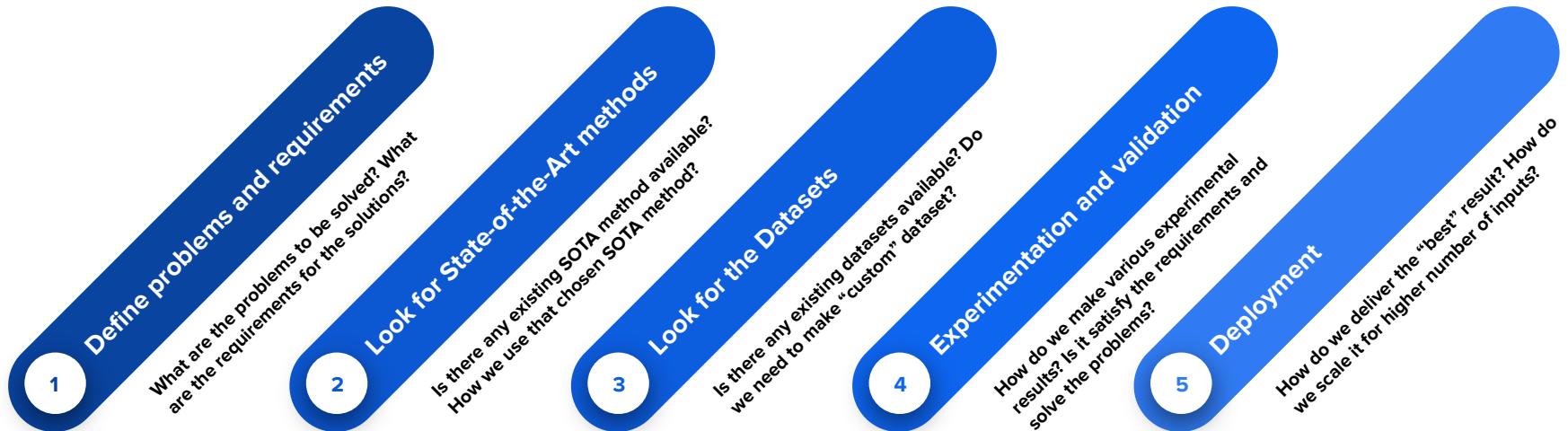
- **Quue Thermal Access Control**
Menganalisa suhu tubuh individu yang didukung deteksi masker dan facial recognition dengan akurasi tinggi
 - **Non-Social Distancing Detection**
mengidentifikasi kerumunan masyarakat berdasarkan jumlah dan jarak *physical distancing*.
-
- **Mask Detection**
Menganalisa kedisiplinan masyarakat di ruang publik dalam menggunakan masker - yang dapat didukung Quue Smart Speaker (CCTV and IoT Based)
- **Vehicle Detection**
Analisa tren mobilitas dan klasifikasi kendaraan di jalan raya



Qlue AI Solutions Development



Development Flow Summary



Agile Software Development



Masked Face Detection Development



Core: Image Classification

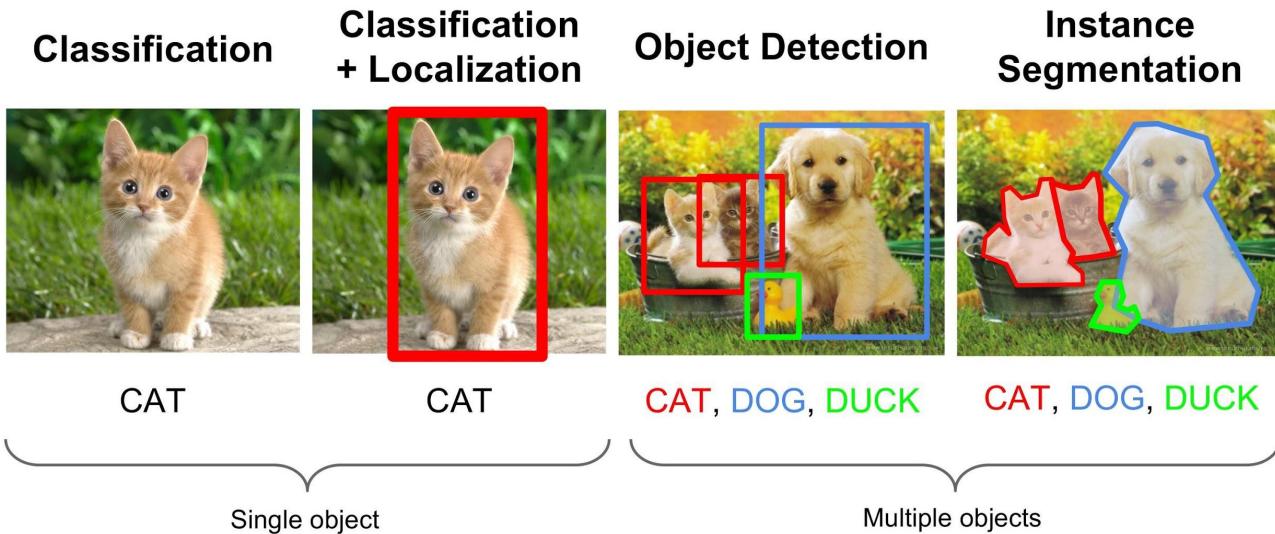


Image taken from

<https://medium.com/zylapp/review-of-deep-learning-algorithms-for-object-detection-c1f3d437b852>

Problem Definition



Fig. 1: Examples of a pair of face images. (a) and (b) are normal face images. (c) and (d) are masked face images.

Taken from <https://arxiv.org/abs/2003.09093>

Requirement Definition

Requirement examples:

1. **Dataset** must be **balanced** for all classes with **no >20% difference**

2. **Accuracy** must reach **>95%**

Definition: How many positive and negative observations were correctly classified.

Formula: $\text{acc} = (\text{tp} + \text{tn}) / (\text{tp} + \text{fp} + \text{fn} + \text{tn})$

3. **ROC AUC** must reach **>0.95**

Definition: area under curve of a chart that visualizes the tradeoff between true positive rate ($\text{TPR} = \text{tp} / (\text{tp} + \text{fn})$) and false positive rate ($\text{FPR} = \text{fp} / (\text{fp} + \text{tn})$).

Reference: <https://towardsdatascience.com/the-ultimate-guide-to-binary-classification-metrics-c25c3627dd0a#a015>

State-of-the-Art Methods

Image Classification on ImageNet

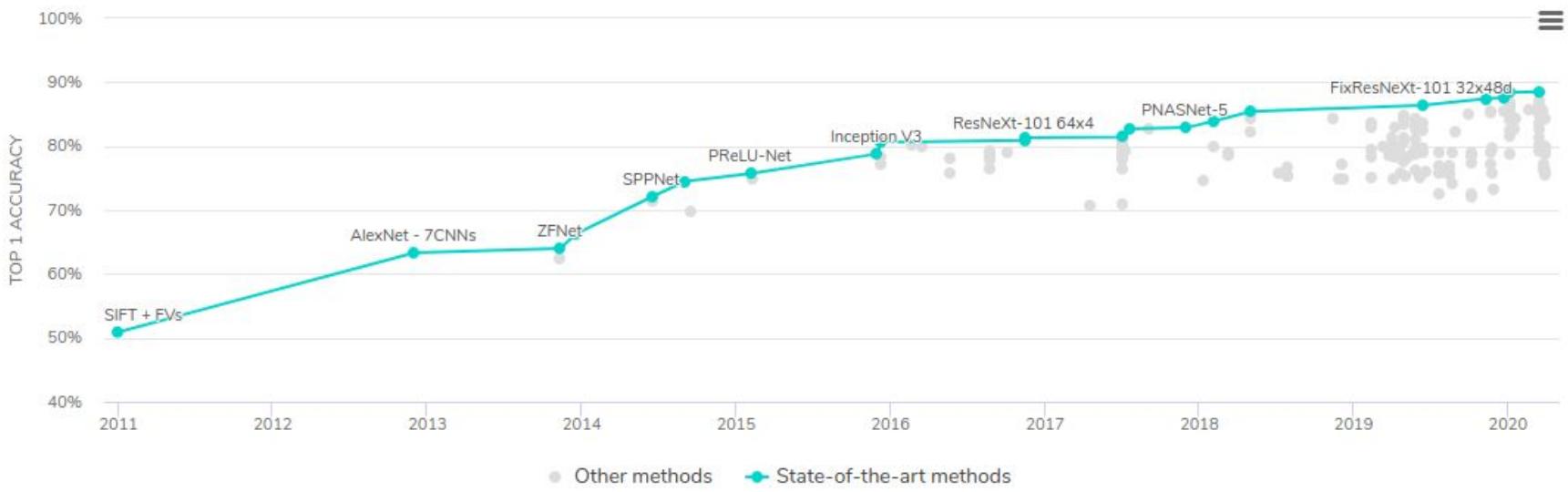
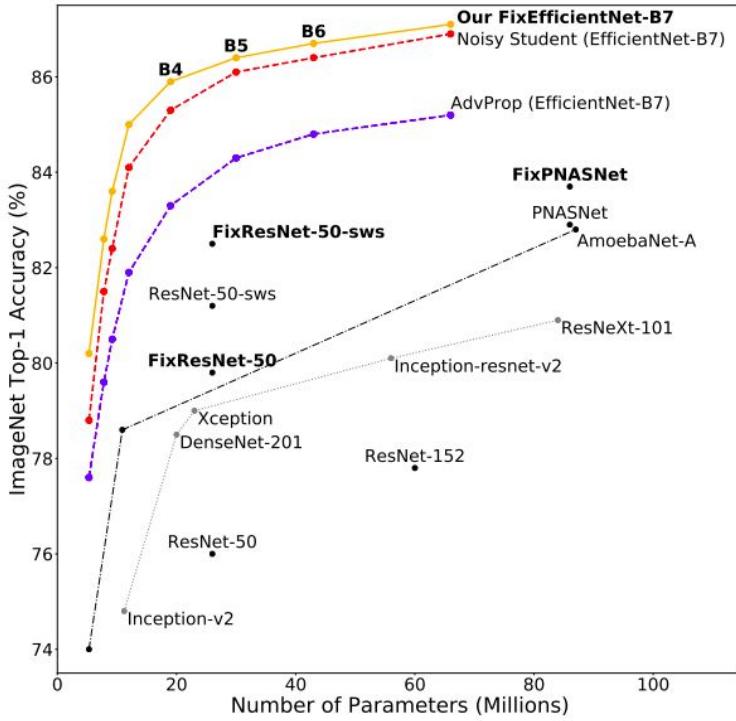


Image taken from <https://paperswithcode.com/sota/image-classification-on-imagenet>

State-of-the-Art Methods



What may makes **Deep Learning SOTA** methods so different:

1. Network architecture
2. Number of parameters
3. Layer types
4. Loss function
5. Training pipeline
6. Data preparation

In this example, we use MobileNet v2.

Image taken from <https://arxiv.org/pdf/2003.08237v3.pdf>

Dataset

kaggle

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Dataset

Medical Masks Dataset

Pictures of people wearing medical masks

Mikolaj Witkowski • updated 2 months ago (Version 1)

Data Tasks Kernels (5) Discussion (1) Activity Metadata Download (146 MB) New Notebook

Usability 8.8 License Other (specified in description) Tags society, health, health conditions, apparel, vision care and 3 more

Description

Context

The dataset comes from Eden Social Welfare Foundation, Taiwan.

Content

The following dataset contains pictures of people wearing medical masks along with XML files containing their descriptions. There are 682 images with over 3000 faces wearing masks and around 700 masks worn either wrongly or not worn at all. The XML files contain their locations and labels good, none or bad.

Acknowledgements

The dataset was shared by Cheng Hsun Teng, I'm uploading it on his behalf.

Inspiration

How many people in the pictures are wearing masks? What's the percentage of people not wearing them? Are the masks worn properly?

URL: <https://www.kaggle.com/vtech6/medical-masks-dataset>

Dataset Preparation

1. Since the dataset originally is an Object Detection task dataset, first we need to make Image Classification task dataset by cropping for each image using provided label files and put cropped images into corresponding class folder (masked / not_masked).
2. Cleaned to minimum face width 20 pixels.
3. We got 453 normal face images and 2495 masked face images.
4. To make the dataset balanced, we add 2042 normal face images (cropped) from LFW dataset.
5. For each cropped image is resized into 96 pixels x 96 pixels.
6. We split the dataset into train : val : test = 0.7 : 0.2 : 0.1 = 3492 : 998 : 500.



Experimentation Strategy

Input	Operator	<i>t</i>	<i>c</i>	<i>n</i>	<i>s</i>
$224^2 \times 3$	conv2d	-	32	1	2
$112^2 \times 32$	bottleneck	1	16	1	1
$112^2 \times 16$	bottleneck	6	24	2	2
$56^2 \times 24$	bottleneck	6	32	3	2
$28^2 \times 32$	bottleneck	6	64	4	2
$14^2 \times 64$	bottleneck	6	96	3	1
$14^2 \times 96$	bottleneck	6	160	3	2
$7^2 \times 160$	bottleneck	6	320	1	1
$7^2 \times 320$	conv2d 1x1	-	1280	1	1
$7^2 \times 1280$	avgpool 7x7	-	-	1	-
$1 \times 1 \times 1280$	conv2d 1x1	-	k	-	-

Taken from <https://arxiv.org/abs/1801.04381>

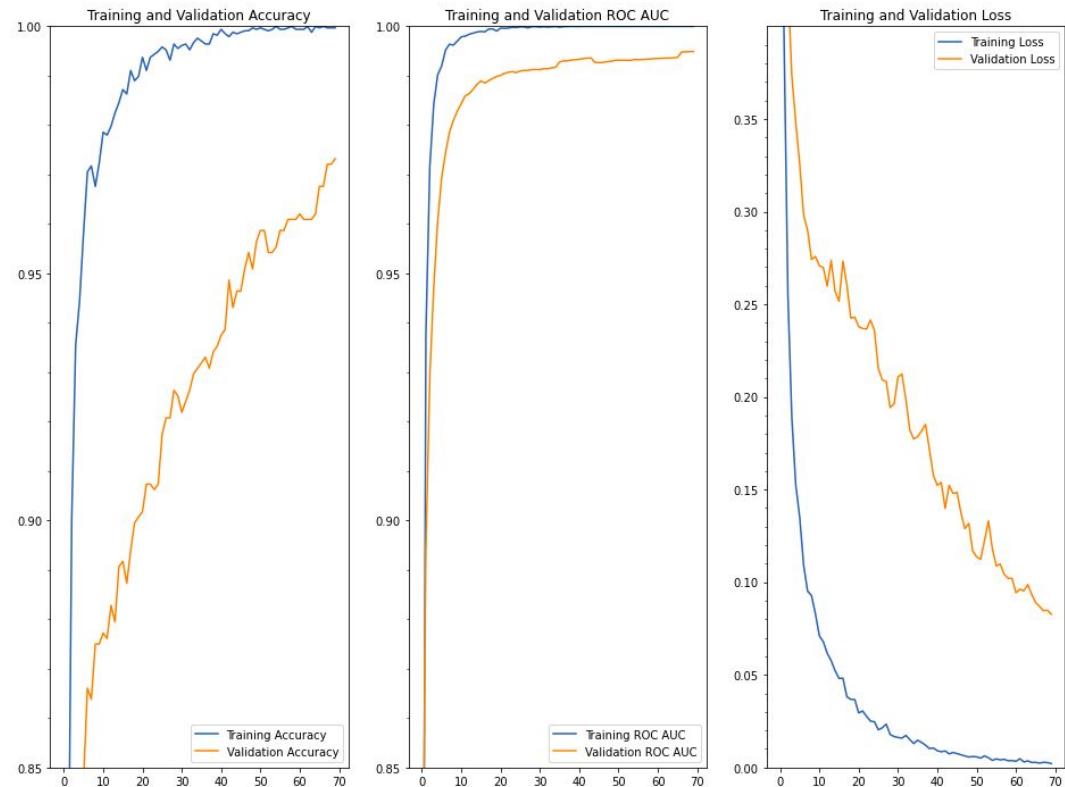
Model: "sequential"

Layer (type)	Output Shape	Param #
mobilenetv2_1.00_96 (Model)	(None, 1280)	2257984
dense (Dense)	(None, 1)	1281
activation (Activation)	(None, 1)	0

- TF 2.x with [Keras](#)
- Network architecture: [MobileNet v2](#)
- [Fine-tuned](#) from ImageNet pretrained model
- Removed fully-connected layer at the top of the network
- Global average pooling applied to the output of the last convolutional block
- Followed with [1 node dense layer](#) and [sigmoid activation function](#)
- Input shape [96x96x3 pixels](#)
- [Data augmentation](#) use horizontal flip and rotation

Experimentation Result

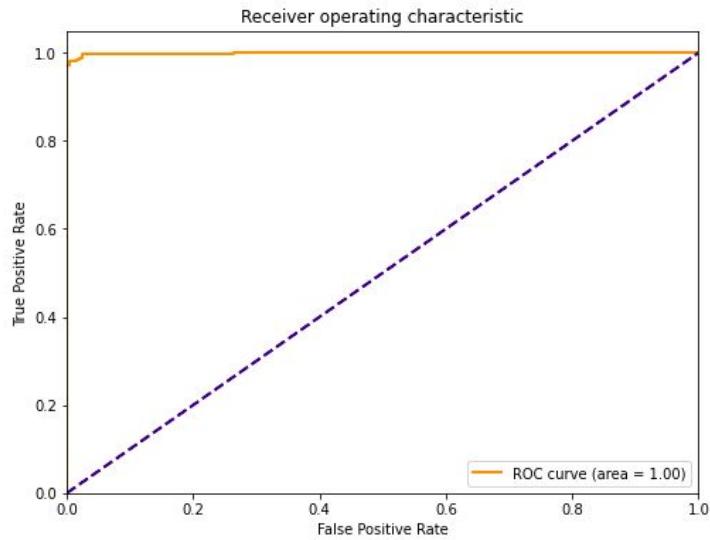
- Adam optimizer with base learning rate $1e-5$
- Binary cross-entropy loss
- Binary accuracy and ROC AUC metrics



Validation

Keras evaluate results (loss, acc@0.5, roc_auc): [0.06208068132400513, 0.978, 0.9975519]

Predict and scikit-learn evaluate results (acc@0.5, roc_auc): 0.978 0.998576



Our training result fulfill the requirements

Deployment

*Another mask
types e.g.
respirator?*

*How about useless
mask?*

*Integrate it with
Facial Recognition?*

Video Stream

...

Masked Face
Image
Classification

...

...

Reporting

*How about night
time?*

Long way to go ...



Expected Impacts



Support Security and Safety Enforcement

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Jokowi: Semua Orang yang Keluar Rumah Wajib Pakai Masker

Kompas.com - 06/04/2020, 10:13 WIB

BAGIKAN:  

Komentar (24)



Presiden Joko Widodo memberikan keterangan pers saat meninjau Rumah Sakit Darurat Penanganan COVID-19 Wisma Atlet Kemayoran, Jakarta, Senin (23/3/2020). Presiden Joko Widodo memastikan Rumah Sakit Darurat Penanganan COVID-19 Wisma Atlet Kemayoran siap digunakan untuk menampung 3.000 pasien. (ANTARA FOTO/HAFIZ MUBARAK A)



Home Nasional Internasional Ekonomi Olahraga Teknologi Hiburan Gaya Hidup CNN TV

Home > Nasional > Berita Peristiwa

Warga Tak Pakai Masker di Banda Aceh Bakal Didenda

CNN Indonesia | Senin, 20/04/2020 02:30 WIB

BAGIKAN:  



Ilustrasi warga menggunakan masker. (ANTARA FOTO/SYIFA YULINNAS).

Banda Aceh, CNN Indonesia -- Pemerintah Kota Banda Aceh bakal membuat memperketat peraturan selama masa pandemi **virus corona** (Covid-19). Melalui Peraturan Wali Kota (Perwal) warga yang tak mengenakan masker di luar rumah bakal dikenakan denda.



Increase Citizen Awareness to Wear Mask

Jumat 17 April 2020, 15:20 WIB

Ngeyel, Ribuan Warga di Jakarta Bepergian tidak Gunakan Masker

Yakub Pryatama Wijayaatmaja | Megapolitan



Antara

Polisi memberikan imbauan kepada pedagang di tepi jalan saat patroli Pembatasan Sosial Berskala Besar (PSBB) di Jakarta, Jumat (17/4).

POLRI melakukan patroli saat aturan Pembatasan Sosial Berskala Besar (PSBB) untuk mencegah penyebaran virus korona (covid-19) di kawasan Jakarta.

Karopenmas Humas Polri Brigjen Argo Yuwono mengatakan, sejak mengatakan sejak pemberlakuan PSBB hingga Kamis (16/4), Polri mendapatkan ribuan orang bepergian tanpa masker dan kendaraan yang membawa penumpang melebihi kapasitas.

PSBB Berlaku di Beberapa Daerah, Banyak Warga Ngeyel Tak Pakai Masker

Irfan Ma'ruf · Senin, 20 April 2020 - 20:09 WIB



Ilustrasi Masker (foto: Antara)

JAKARTA, iNews.id - Sejumlah daerah telah menetapkan Pembatasan Sosial Berskala Besar (PSBB). Polisi masih menemukan banyak pelanggaran.

Kabag Penum Mabes Polri Kombes Asep Adisaputra mengatakan mayoritas pelanggaran yakni warga tidak menggunakan masker. Jumlahnya mencapai 11.240 pelanggar.

Rapid AI Development Cycle



Cornell University

arXiv.org > eess > arXiv:2003.05037

We gratefully acknowledge support from
the Simons Foundation and member institutions.

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Electrical Engineering and Systems Science > Image and Video Processing

[Submitted on 10 Mar 2020 ([v1](#)), last revised 24 Mar 2020 (this version, v3)]

Rapid AI Development Cycle for the Coronavirus (COVID-19) Pandemic: Initial Results for Automated Detection & Patient Monitoring using Deep Learning CT Image Analysis

Ophir Gozes, Maayan Frid-Adar, Hayit Greenspan, Patrick D. Browning, Huangqi Zhang, Wenbin Ji, Adam Bernheim, Eliot Siegel

Purpose: Develop AI-based automated CT image analysis tools for detection, quantification, and tracking of Coronavirus; demonstrate they can differentiate coronavirus patients from non-patients. Materials and Methods: Multiple international datasets, including from Chinese disease-infected areas were included. We present a system that utilizes robust 2D and 3D deep learning models, modifying and adapting existing AI models and combining them with clinical understanding. We conducted multiple retrospective experiments to analyze the performance of the system in the detection of suspected COVID-19 thoracic CT features and to evaluate evolution of the disease in each patient over time using a 3D volume review, generating a Corona score. The study includes a testing set of 157 international patients (China and U.S). Results: Classification results for Coronavirus vs Non-coronavirus cases per thoracic CT studies were 0.996 AUC (95%CI: 0.989-1.00) ; on datasets of Chinese control and infected patients. Possible working point: 98.2% sensitivity, 92.2% specificity. For time analysis of Coronavirus patients, the system output enables quantitative measurements for smaller opacities (volume, diameter) and visualization of the larger opacities in a slice-based heat map or a 3D volume display. Our suggested Corona score measures the progression of disease over time. Conclusion: This initial study, which is currently being expanded to a larger population, demonstrated that rapidly developed AI-based image analysis can achieve high accuracy in detection of Coronavirus as well as quantification and tracking of disease burden.

Comments: 19 pages, 6 figures

Subjects: [Image and Video Processing \(eess.IV\)](#); Computer Vision and Pattern Recognition (cs.CV); Machine Learning (cs.LG)

Cite as: [arXiv:2003.05037 \[eess.IV\]](#)

(or [arXiv:2003.05037v3 \[eess.IV\]](#) for this version)

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References & Citations

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Technological Advancement



Masked Facial Recognition

Summary



What We Have Learned Today

- ★ How we identify solution needed during COVID-19
- ★ What Qlue AI do to help our nation fighting today's pandemic
- ★ Development process for AI solution
- ★ What AI could do to help preventing the spread of COVID-19



References

- Image classification tutorial:
<https://www.tensorflow.org/tutorials/images/classification>
- Medical masks dataset:
<https://www.kaggle.com/vtech6/medical-masks-dataset>
- MobileNetV2: <https://arxiv.org/abs/1801.04381>
- Binary classification metrics:
<https://towardsdatascience.com/the-ultimate-guide-to-binary-classification-metrics-c25c3627dd0a#a015>
- Supplementary learning material:
<https://github.com/muhammadsyahyas/masked-face-image-classification>

